

REMARKS

This Amendment “A” is submitted in response to the non-final Office Action dated August 17, 2004, wherein claims 1 and 23 were rejected and claims 2 – 22 were said to be allowable but were objected to as being dependent on a rejected base claim. By this amendment applicant has amended claims 1, 2 and 23. Claims 1 – 23 remain pending. Reexamination and reconsideration in view of the foregoing amendments and following remarks are respectfully requested. Accompanying this Amendment is a Supplemental IDS submitting prior art identified in a search report by the European Patent Office in connection with a related application.

Request for Clarification Regarding Claims 10 – 22

The examiner identifies claims 10 – 22 as being among the group of claims that were “objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.” Applicant respectfully points out that claim 10 is an independent claim, and claims 11 – 22 are all dependent, directly or indirectly on claim 10. Therefore, applicant understands the Office Action to mean that these claims are allowable in their present form and, therefore, they have been left unchanged.

Claim Amendments

Claim 1 has been amended in minor respects to clarify a possible inconsistency. Specifically, as originally drafted claim 1 referred to “one or more” contact pads on both the sensor die and on the external circuit. In view of the fact that the final step in the claimed method requires that the process be repeated, applicant believes it is better to specify that there are a plurality of pads.

Claim 2, which was said to be allowable if rewritten in independent form, has been rewritten to incorporate the limitations of claim 1, upon which it formerly depended. In doing so, applicant made the same correction to the wording as is described above in respect to claim 1. Claims 3 – 9 are all dependent, directly or indirectly, upon claim 2, and have not been amended. With the amendment of claim 2, each of these claims is now in condition for allowance.

Claim 23 has been amended to recite that the claimed wire bonding method uses a ball formed at the end of a wire. This is consistent with the other claims.

Traversal of Rejections

Claims 1 and 23 were rejected as being anticipated under 35 U.S.C. § 102(b) by U.S. Pat. Nos. 5,907,627 and 5,862,248 to Borza and Salatino et al., respectively. Applicant respectfully traverses these rejections. Borza and Salatino et al. teach the use of wire bonding to connect contact pads on a fingerprint sensor die with contact pads on a carrier. Both patents are similar to the prior art which is discussed in the Background of the present application, as depicted in FIGS. 1 and 2. In the prior art, ball bonding equipment first placed a ball on a contact pad on a die and then looped the wire to a contact pad on the carrier where it formed a stitch connection. As described in the article discussed below, making a stitch connection to a contact pad on a chip die was considered risky because of potential damage to the chip.

In contrast to the prior art, claims 1 and 23 of the present invention both require that ball wirebonding be performed opposite to the conventional way, such that the wire ball is placed first on the carrier pad and the wire is then looped over to a pad on the fingerprint sensor die, where it is joined by a stitch connection. Applicant discovered that by using this non-conventional wire bonding process he could achieve a low loop height. In addition, the present application teaches the importance of low loop height to enhance the accessible area of a fingerprint sensor.

Thus, method claims 1 and 23 both require that a specific ball wirebonding process be used. Neither Borza nor Salatino et al. teach the claimed ball wirebonding process and, therefore, neither reference anticipates claims 1 or 23. Note that there are other types of wirebonding processes besides ball bonding. To the extent that Salatino shows what appears to be a ball wirebond (see FIG. 13) the ball is placed on the die contact, as is conventional.

Neither Borza nor Salatino et al. discuss the importance of minimizing the height of the encapsulant which protects the wire bond connections or of the importance of minimizing the loop height of a wire bond. Therefore, neither of these references recognizes the problem solved by the present invention or provides any suggestion or motivation for employing the claimed wire bonding process.

Supplemental IDS

Submitted herewith is a Supplemental IDS forwarding prior art cited in a European Search Report in a related case. All but one of the references are listed in category "A," *i.e.*, "technological background." It is believed that none of these references require discussion.

However, one reference, an article by Babinetz, et al. entitled, "Looping Challenges in Next Generation Packaging," is listed in category "X," *i.e.*, "particularly relevant." (Hereinafter this article will be referred to as "the Babinetz article.")

Initially it is noted that the Babinetz article makes no mention of fingerprint sensors or of the special problems associated therewith. Therefore, it clearly does not anticipate the present invention. It appears that the European searcher has focused a passage in Babinetz, beginning on page A-6, which obliquely discusses "reverse bonding." However, it appears that the "reverse bonding" technique described in the Babinetz article, also called "Stand-Off Stich" and "Stitch-on-Ball" is much different than what is claimed in the present application. Specifically, the Babinetz article describes the "reverse bonding" technique as utilizing a "bumped ball" which is "first bonded at the location of the second bond." Thus, this reverse bonding technique involved first placing a bumped ball on a first contact pad, then attaching a wire bond ball on the second contact pad, and finally using a stitch connection to attach the wire *to the bumped ball*. Thus, in this process *both* pads have balls formed thereon. The Babinetz article goes on to state that: "The bumped ball is necessary when reverse bonding to chip pads because a ball bonder tool could cause damage to this area when it comes in contact with the surface during bonding."

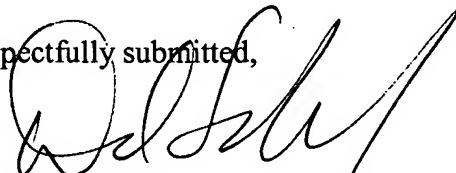
Table 3 of the Babinetz article shows that the technique that is described does not achieve the low loop heights of the present invention because of the use of a bumped ball on the die contact pad. Specifically, the combined height of the ball (58.7 μm) and loop (40.7 μm) means that the loop projects a distance much greater than mils above the surface of the die.

Conclusion

For the foregoing reasons it is respectfully submitted that all of the pending claims of the application are in condition for allowance, and such action is earnestly solicited. The examiner is invited to call the undersigned at the phone number listed below if doing so might advance the prosecution of the application.

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Respectfully submitted,



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